

ILLUSTRATED CONCEPTS IN TROPICAL AGRICULTURE

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RESIDUAL EFFICIENCY OF FERTILIZER PHOSPHORUS: FIELD EVALUATION



A crop of maize yielding 5 tons of grain per hectare contains about 30 kg phosphorus in the total crop. Usually, even if the crop has been heavily fertilized, a major portion of the P is contributed by the soil. Typically, fertilizer P contributes 5 to 10 kg P/ha to the crop. If large quantities of P have been added to the soil, the percentage recovery in the crop to which the fertilizer was applied is invariably low. Efficiencies of 20% or less of fertilizer P recovered are not unusual. Calculations of this type, applied to those soils of the humid tropics where phosphate is strongly sorbed by sesquioxide materials in the soil, have led to erroneous conclusions about P fertilizer inefficiency. In fact, P fertilizers may have long-term residual effects. The photograph and graph presented above demonstrate that evaluation of P fertilizer efficiencies should be based on the results of several years of fertilizer P recovery. These results were secured from long-term experiments established in 1958 on the Island of Kauai. The soil was a Gibbsihumox, Kapaa series. Weathering and leaching had so desilicated the parent rocks that only oxides of aluminum and iron remained as important constituents of the soil. The soil sorbed phosphate in such large quantities that heavy phosphate fertilizer applications were required to provide adequate P for the *Digitaria-Desmodium* forage mixture established there. Nutrients other than P were applied as needed for good production.

The photograph presents the general appearance of the plots 8 years after the P applications were made in amounts ranging from zero to 1340 kg P/ha. In the foreground is a plot that had not been phosphate-fertilized. The plot in the middle-ground right received 670 kg P/ha, and the tall growth in the background, dominated by the legume, received 1340 kg P/ha.

The line graph presents a summary of the yield data for certain of these plots. Phosphorus removed during 9 years from the heavily P-fertilized plot—in excess of P in the no-P plot—was 520 kg/ha, approximately 40% of the quantity applied. Even then, the residual effects of the P fertilizer were not exhausted, as is evident from the yield response curve for 1968–69. These data suggest that most calculations of fertilizer efficiencies, which do not include residual P, often underestimate P efficiencies.

